



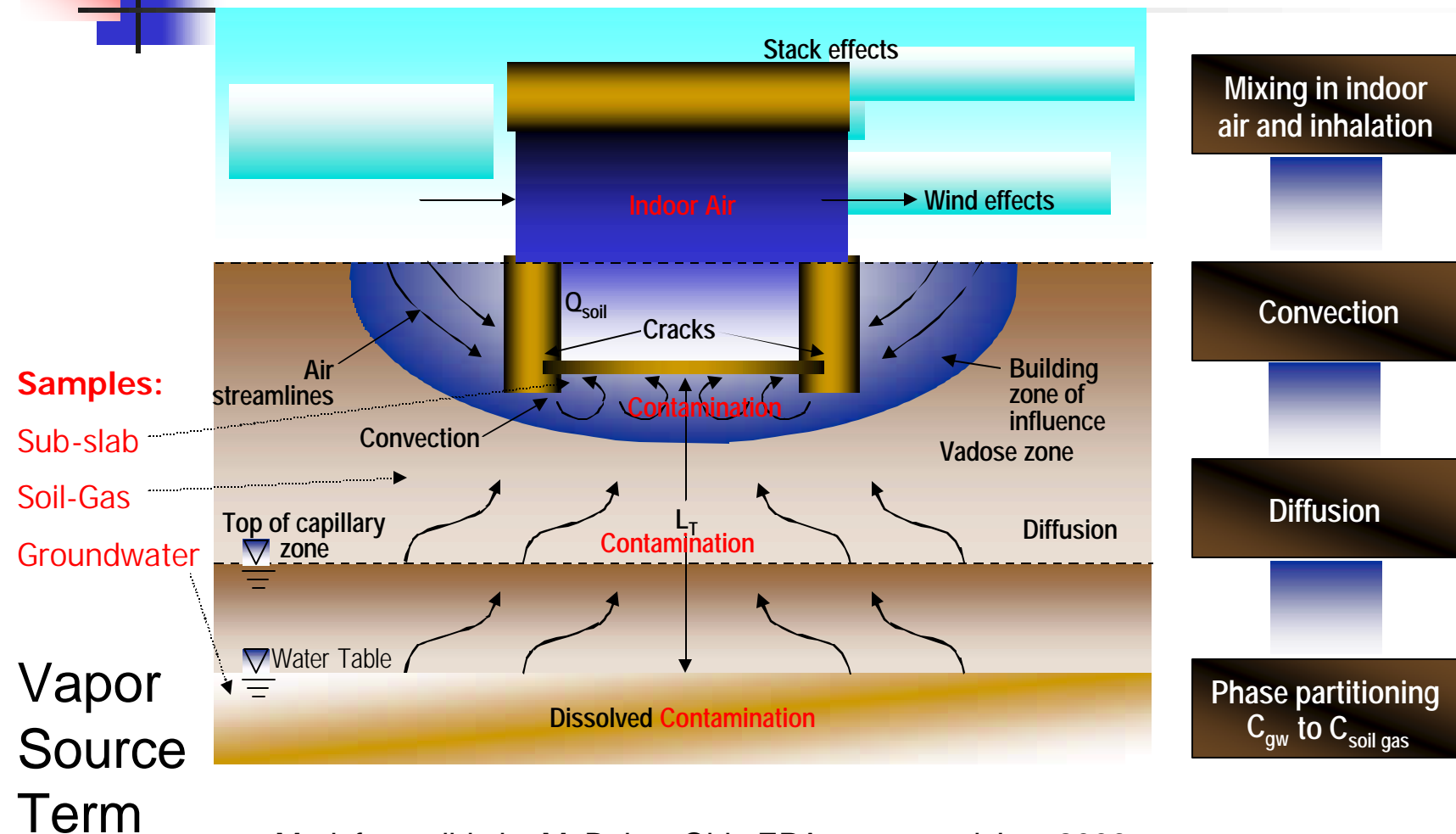
EPA Perspective On VI & Update on Current HQ Activities

National Forum on Vapor Intrusion
USEPA Region 3, Philadelphia, PA
Jan. 12, 2008

Presented by:
Henry Schuver, DrPH
USEPA – Office of Solid Waste

See: <http://iavi.rti.org> & www.envirogroup.com/vaporintrusion

Conceptual model of the vapor intrusion exposure pathway

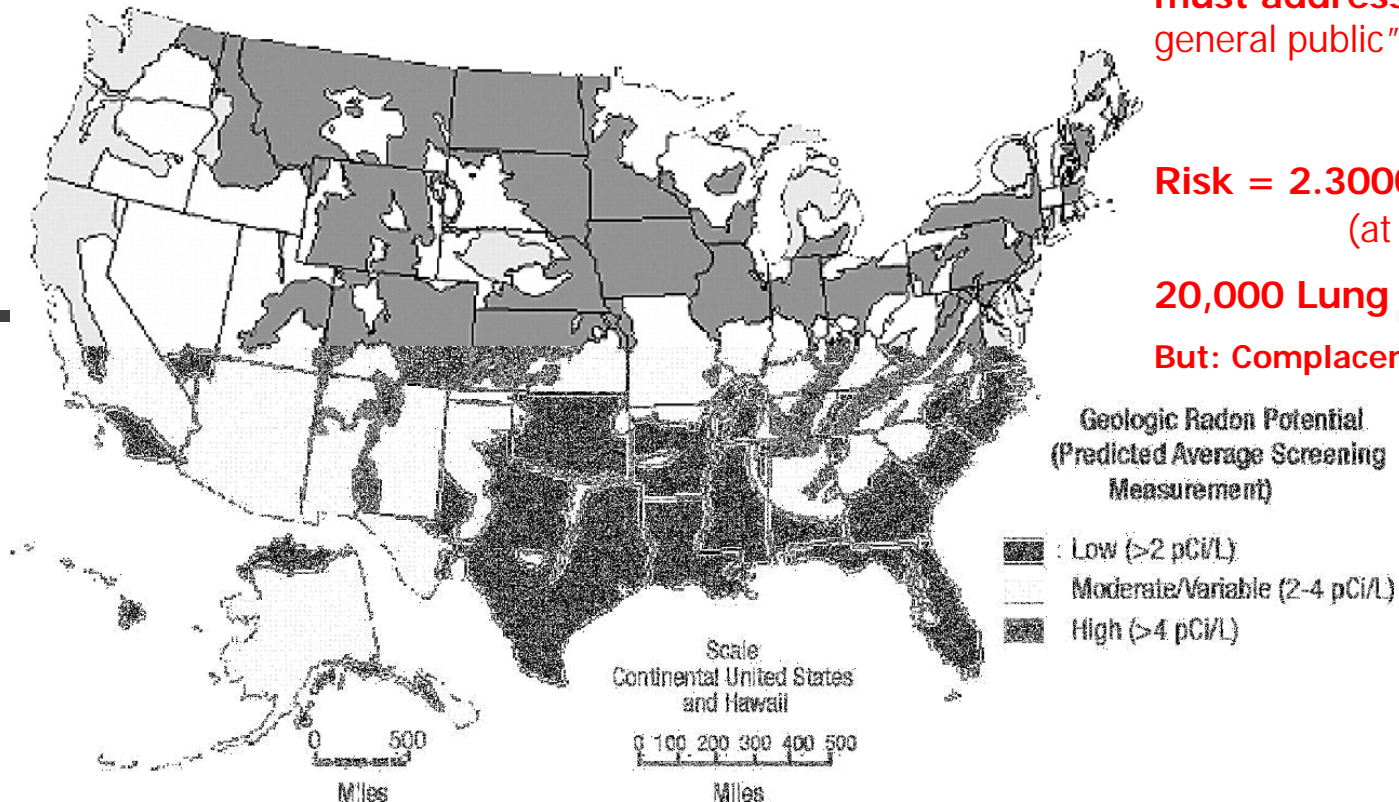


Mod. from slide by M. Bolas, Ohio EPA, presented Jan. 2006

RADON

FIGURE 1

Generalized Geologic Radon Potential of the United States
by the US Geological Survey



*EPA's Perspective on
Risks from Residential Radon
Exposure*

"Indoor **radon** ... **the most serious** environmental carcinogen which the **EPA must address** for the general public" Puskin 1989

Risk = 2.3000%
(at 4pCi/L)

20,000 Lung Cancers/yr

But: Complacency & Costs

Jalbert, 2004

From Frumkin, H. et al.
CA Cancer J Clin 2001;51:337-344.

The same VI pathway

Real 'background' for chemical VI

Chemically exposed get **both**

CA
A Cancer Journal for Clinicians



Overview of the VI Pathway

- *Chemicals* with evidence of toxicity, e.g.,
 - PCE, TCE, DCE, VC, ...
 - Carcinogenicity, neuro- & immuno- developmental ...
- Evidence of migration to receptors
- Exposure point conc. > 'acceptable'
- Inhalation is relatively unavoidable
 - 'Uninvited guest'
 - Many similarities to tap-water exposures



Exposure Factors

(Water Ingestion & Inhalation)

- Water - **2** liters/day of water (ingestion) *voluntary*
- Air - **20** m³/day (20,000 liters/day) of air (inhalation)
 - Exposure factors **1:10** (in units of 2 l/d and 20 m³/d)
 - **For equal exposures:**
 - Inhalation conc. (in m³/d) should be **1/10** of Ingestion (in l/d)
- Comparing similar exposure Conc.: Exposure Daily
 - **MCL = 5 ug/l** (water) (x 2 l/d = 10 ug/d)
 - Similar exposure ~ 0.5 ug/m³ (air) (x 20 m³/d = 10 ug/d)
 - Example indoor air concentrations:
 - **1** ug/m³ ~ **MCL** of **10** ug/l
 - **10** ug/m³ ~ **MCL** of **100** ug/l
 - **100** ug/m³ ~ **MCL** of **1,000** ug/l



Dominant Features of VI Pathway

- Uncertainty
 - Lack of knowledge
 - Reducible (in theory; e.g., intervening geology)
- Variability
 - Known to vary (range of y), but is unpredictable
 - Irreducible (e.g., pressure differences in subslab-indoor)
 - Need statistics (populations of data) to describe - historical
 - Temporal (variation Across Time)
 - Spatial (variation Across Space)

Vapor Intrusion is Real (and variable)

(sometimes visible)

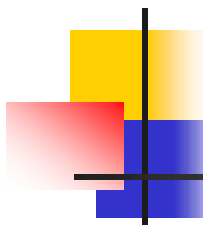
Photo from:
Dave Webb,
Ill. DPH
Hartford, Ill. case



Temporal Variability

TABLE 3-1 Intermittent Events in Spring
(high water levels & short separation distances = less biodeg?)

Addresses of Odor Complaints and Fires in Hartford, Illinois



How many
24-hr.
samples
would it
take to
characterize
this
variability?

ADDRESS	COMPLAINT	DETAILS
Street	Fire	05/20/1990
Street	Fire	03/27/1978 – Fire in basement and kitchen
Street		78-3
Street	Fire & Gas	03/20/1978 – Gas odor; 03/24/1978 – Fire in basement and sewer drain; 05/16/1990
Street		78-1 78-2
Street		12 years later
Street (Front)		
Street (Rear)		
Street		9 years later
y Street		
y Street	Fire	08/21/1981; 03/21/1990
y Street	Fire	04/23/1970 – Explosion due to gas
ry Street		11 years later
ry Street	Fire	03/30/1978 – Fire in basement
ry Street		78-4
ry Street		
ry Street		
ry Street		
ry Street		
ry Street		

Earliest observation (1970)

- Atmospheric Press. Fluctuations & Soil Properties Robinson 1997
- Soil response time, Soil capacitance Robinson 1997
- Bldg Heating type: fire or elec. Mose 1997
- Bldg. Concrete poured or block, Home **use patterns** Mose 1997
- **Living Habits** Miles 1998
- Independent heat (vs. shared apt.) Gallelli 1998
- Type of window frames & # panes, Bldg. Story level Gallelli 1998
- Local geology, Superficial cover Miles 1998
- Air/barometric pressure, Wind direction Riley 1999
- Fluctuation in wind direction, Wind speed Riley 1999
- Fluctuation in wind speed, Wind (loading) Riley 1999
- **HVAC**/Ventilation systems (installed, & operations) Riley 1999
- Combined Surface Geology, Topography & Wind Direction Keskikuru 2000
- Soil-gas pressure (wind induced) Keskikuru 2000
- Indoor-Attic space Keskikuru 2000
- Soil-indoor pressure difference Font 2001
- Frozen soil as cover (temp. & water) Winkler 2001 *Mickunas 2007*
- Saturated soil as cover (Summer) Winkler 2001
- Sunshine duration, Snow coverage, **Fuel prices** (bldg insulation) Papp 2001

Steck 2007

American Association of Radon Scientists and Technologists 2007 Proceedings
Of the 2007 AARST International Symposium Jacksonville, FL, 2008©AARST

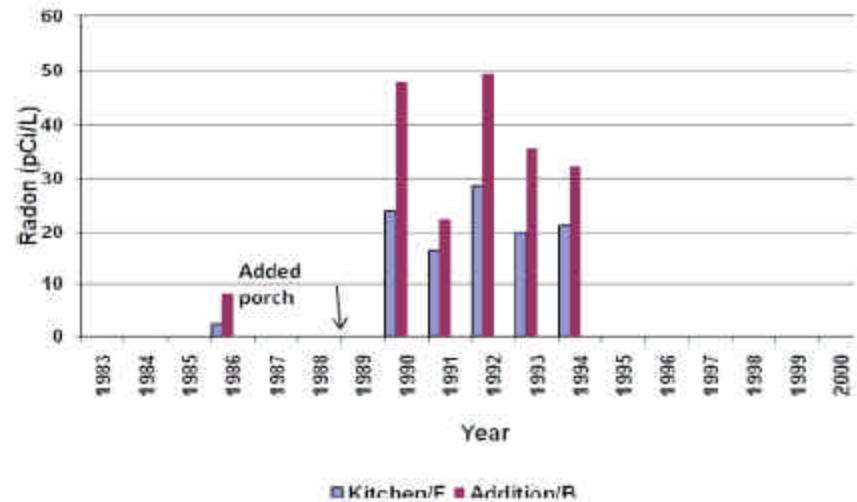
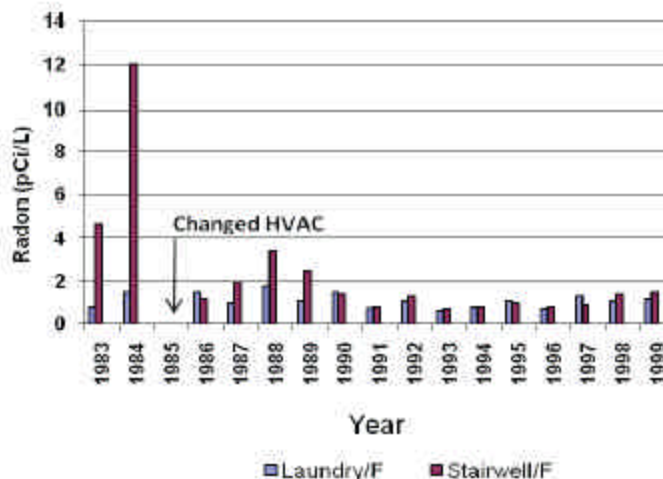


Figure 4 Examples of large radon changes created by house modifications

1,1 DCE in Indoor Air

(Redfield Facility, Denver, Colo., Folkes, 2000)



Since 1994
Radon
experts only
talk about
“potential”
% of homes
in an area –

Only way to
know about
any specific
building is to
sample it.

“point” in time

- Temporality

- Mobile plume

Spatial Variability

But within the plume (source)

2008 - Now we ask,
which sub-slab
sample do we use
for alpha?

> 44 x

0.118
Observable
but not the
real alpha?

1,1,1-TCA
8.1

1,1-DC
0.94

TCE
30

Soil-Gas Location 89

Question 10

UNITED STATES

20

$$I =$$

1,1,1-TCA
7.9

1,1-DC
3.7

TCE
20



Play Area

TC
8

11

Soil-Gas Location 88

Using sub-slab *mean* – $\text{Alpha}_{ss} = 0.11/16 = 0.0065$

Using sub-slab point **C** – $\text{Alpha}_{ss} = 0.11/0.94 = 0.118$

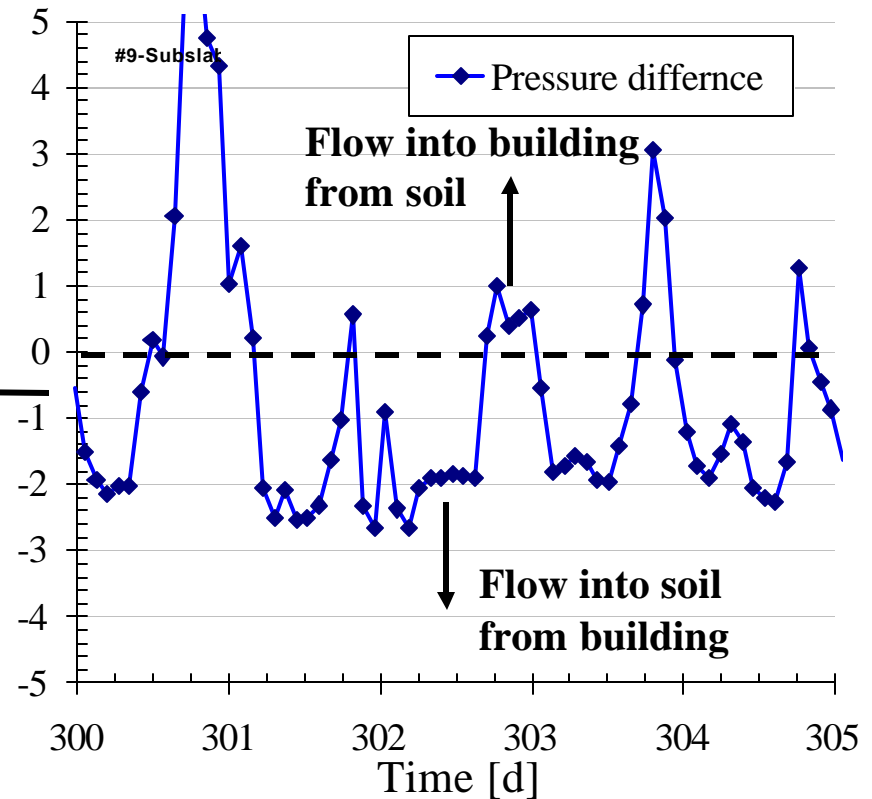
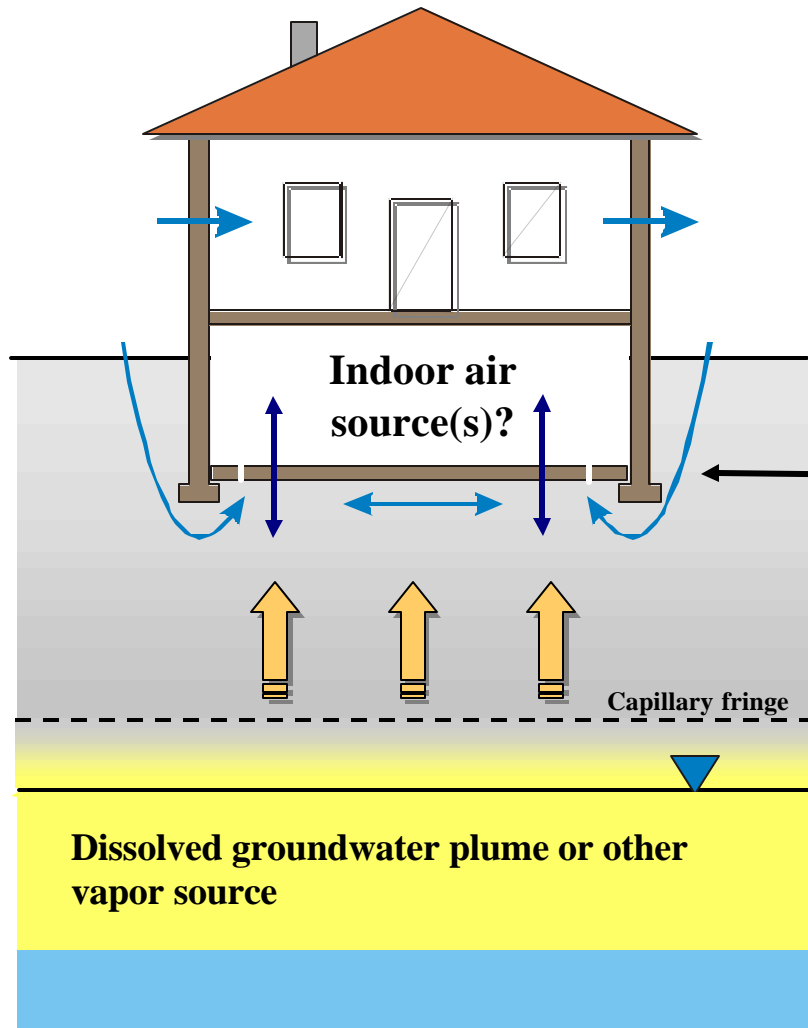
Slide by **D. Digiulio** (EPA-ORD)

w/ mod. HJS

Indoor Air 11DCE = 0.11 ug/m3

Challenges with the MLE Approach

[temporal variability in sub-slab and near-foundation data]



**Temporal Variability
Building Breathing**

'Direction' of VI Assessment & Public Involvement

Which direction leads to earlier public involvement?



EPA 2002

1 - Above a source?

**2 - Semi-Site Specific
Attenuation Factors (Fig. 3)**

**3- Structure
sampling (IA/SS)**

**EPA Regional
(& State) Guidance:**

**Adds details &
reality to IA/SS**

SERDP-ESTCP

Dec. 2008

Many advantages were described (including: improved public trust, Confidence & Efficiency)



The USEPA's Current Approach to VI ('Roadmap')

- 8 Spokes
 - Brownfields VI Primer
<http://www.brownfieldstsc.org>
 - 2002 draft VI Guidance
 - ITRC VI "Practical Guide" (vol. 1)
 - VI Database (doc. & data) draft @ <http://iavi.rti.org>
 - Background Indoor Air Concentrations (to public soon)
 - Conceptual Site Models (to public soon)
 - VI in Non-Residential Settings
 - TCE & VI Memorandum
- Hub – "Roadmap"



EPA is Continuing to Work on VI

- To keep pace with evolving understanding:
 - EPA is Continuing the Dialogue with:
 - federal partners
 - state regulators
 - industry
 - academia
 - environmental groups, and
 - general public;
 - And is dedicated to improving the “confidence & efficiency” of vapor intrusion **prevention**
- This conference is a major contribution